

A NEW *PAGURAPSEUDES* (CRUSTACEA: TANAIDACEA) FROM SOUTHERN FLORIDA

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ABSTRACT

A new species of the shell-inhabiting tanaidacean genus *Pagurapseudes* is described from Key Largo and Biscayne Bay, Florida. *Pagurapseudes largoensis* n. sp. is the third species known to bear coarse teeth proximally on the incisor process of the mandibles, a character unique to the genus. Closest affinities are with *P. laevis* Menzies from the eastern Pacific. A single-jointed, rudimentary, chelipedal exopodite is noted for *P. spinipes* Whitelegge.

The number of species in the monokonophoran tanaidacean genus *Pagurapseudes* has been increased to a total of seven by recent descriptions (Bacescu, 1976; Gutu and Gomez, 1976). Two species, *P. bouriyi* (Bouvier, 1918) and *P. gutarti* Gutu and Gomez, 1976, are described from the Caribbean Sea, on the south coast of Cuba. *Pagurapseudes laevis* Menzies, 1953 is found in the eastern Pacific, from California to northern Mexico. The remaining members of the genus, *P. spinipes* Whitelegge, 1901, and *P. varians*, *P. tricoliae*, and *P. dactylifrons* Bacescu, 1976, occur in the western South Pacific and Indian Oceans. This paper describes an eighth species, from the Atlantic coast of southern Florida.

The genus *Pagurapseudes* is composed of species which inhabit and transport gastropod mollusc shells in the manner of pagurid crabs. This adaptation has imposed modifications of form which are remarkably similar to some characteristics of the hermit crabs. Their mode of life and small size renders these tanaidaceans particularly inconspicuous, and suggests the probability that the genus is much better represented than present literature indicates.

Pagurapseudes largoensis new species Figure 1

Material Examined.—Florida, Monroe County: Key Largo, 30 May 1967, western shore of Largo Sound, in sand under rocks, depth 0.1 m; 142 females, 61 males, 43 juveniles; D. R. Moore and L. B. Holthuis, colls. Florida, Dade County: Soldier Key, 3 March 1967, from algae and sponge, depth 1 m; 1 male; E. S. McSweeny, coll. October, 1965, from sand and algal clump from flats southeast of Key; 1 female; G. Y. Hendrix, coll. Key Biscayne at Bear Cut, 0.5 km east of Bear Cut Bridge, 19 March 1965, coarse sand and gravel, depth 1.5 m; 1 female; E. S. McSweeny, coll.

Type Locality.—Florida, Monroe County, Key Largo. Western shore of Largo Sound, below low tide mark.

Location of Type Material.—Holotype, allotype, and thirty paratypes are deposited in the National Museum of Natural History, Smithsonian Institution, catalog numbers USNM 180165, 180166, and 180167, respectively. Thirty paratypes are deposited in the Rijksmuseum van Natuurlijke Historie, Leiden, registered number Crust. I.5999. Thirty paratypes are deposited at the Rosenstiel School of Marine and Atmospheric Science, University of Miami, Florida, Accession Number 32:5654. The remaining specimens are in the author's possession.

Description of Female.—(Holotype, Fig. 1A.) Preparatory female with small oostegites. Length 4.02 mm, width at carapace 0.82 mm. Carapace and pereon considerably depressed. Color in life white, with tips of chelae and dactyli of second pereopods brown.

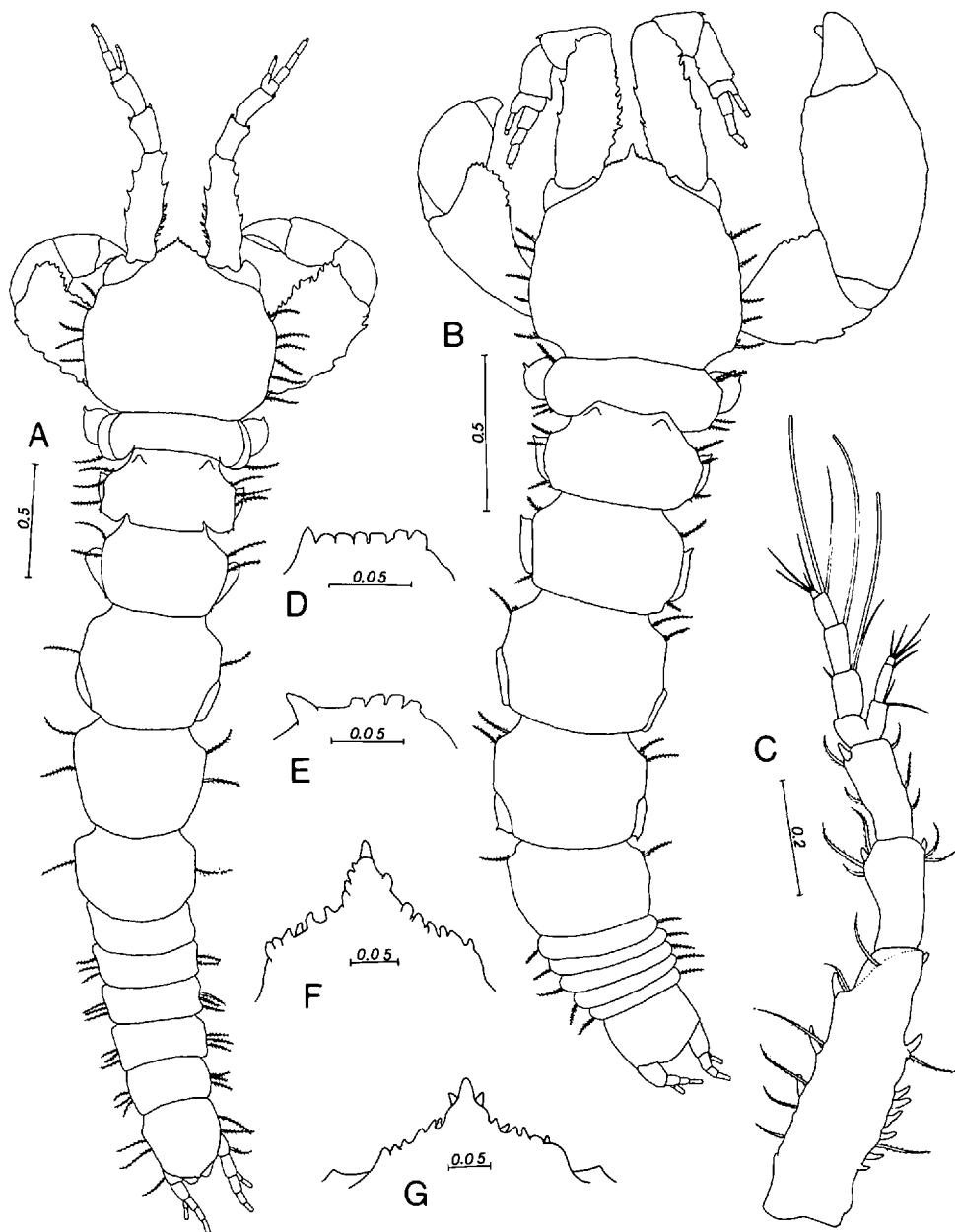


Figure 1. *Pagurapseudes largoensis*, n. sp. A, C, D, F: Female holotype. B, E, G: Male paratype. A, B: dorsal view. C: first antenna. D, E: ventral margin, left eyelobe. F, G: rostrum. Scales in mm.

Carapace slightly wider than long. Rostrum (Fig. 1F) pointed, slightly deflexed; margins armed with close-set teeth. Epistome bearing two small, median spines and two minute denticles. Eyelobes with distinct black visual elements; ventral margin with row of cuboidal teeth and triangular tooth mesially (Fig. 1D). Dorsal surface of carapace, first joint of antennular peduncle, and chelipeds finely granulate.

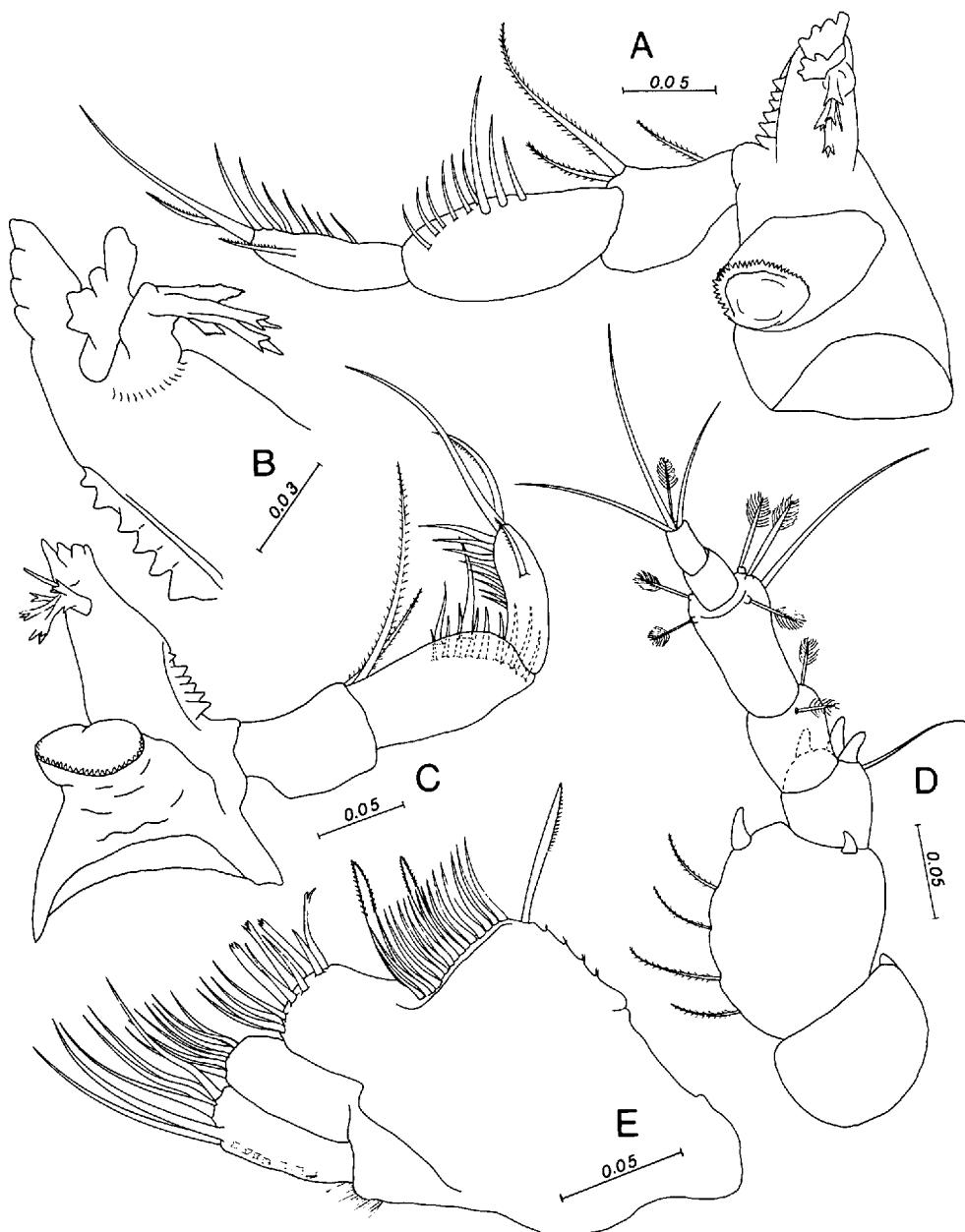


Figure 2. *P. largoensis*, n. sp. A, C, D, E: Appendages of female holotype. A: left mandible. B: male paratype, incisor process of left mandible. C: right mandible. D: second antenna. E: left maxilla. Scales in mm.

Pereonite 3 with slight protuberance on either side anterodorsally. Posterior corners of this and following segment each bear two minute teeth. Remainder of pereonites unarmed. Oostegites borne on coxae of pereopods 2-5.

Pleon slightly more than one-fourth of total length. First pleonite bearing ru-

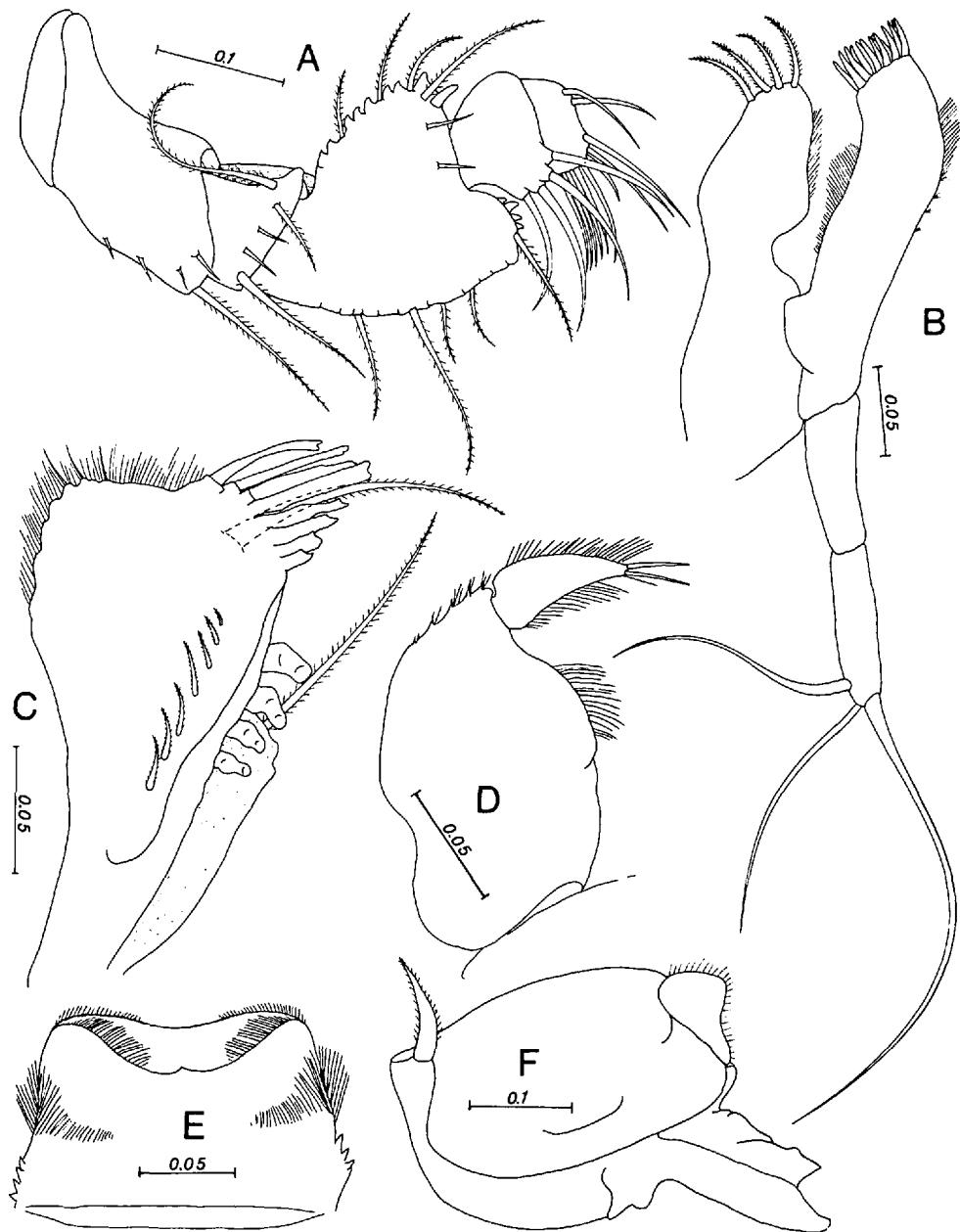


Figure 3. *P. largoensis*, n. sp. Appendages of female. A: right maxilliped. B: maxillula. C: endite of left maxilliped. D: labium, left side (paratype). E: labrum. F: epipodite of right maxilliped. Scales in mm.

dimentary pleopods. Pleonites with nearly straight lateral margins, pleotelson rounded posteriorly.

First antenna (Fig. 1C) with peduncle longer than carapace, rather wide, bearing very short flagella. First joint armed with stout spines on lateral margins,

interspersed with plumose setae. Second joint with two blunt spines at distal angles, third joint with similar spine at outer distal angle only. Flagella have first joint in common, with inner portion twice as long and half as wide as outer. Inner flagellum two-jointed; outer four-jointed. First three joints each bear an aesthetasc at inner distal corner. Terminal joint set at outer edge of third joint, with four terminal setae.

Second antenna (Fig. 2D) seven-jointed, two-thirds the length of first peduncular joint of first antenna. Basal joint small and rounded, slightly produced on inner distal margin. Second and third joints with blunt spines and setae. Fourth, fifth and terminal joints bearing sensory setae.

Labrum (Fig. 3E) rounded, indented distally, with a thick mat of short hairs, lateral margin with longer hair-like setae. Basal portion of lateral margin bearing several minute triangular teeth.

Labium (Fig. 3D) with spiniform setae on distal margin. The lobe terminates in two long spines.

Mandibles (Figs. 2A,C) stout, with three-jointed palp. First joint of palp bearing two plumose setae; second with row of simple spines; distal joint with simple spines and long, curved, setule-bearing spines distally. Stem of incisor process bearing row of six sharp, triangular teeth along proximal half, commencing distal to palp on anterior margin. Setal cluster of both mandibles with five spines: one simple, three bifid, one trifid. Molar process dentate on distal circumference.

Internal endite of maxillule (Fig. 3B) with four spines on distal margin, two strongly curved and all provided with numerous setules. External endite bearing thirteen stout spines distally. Palp two-jointed, with three simple setae distally.

Maxilla (Fig. 2E) with two setule-bearing spines posterior to row of filter setae on medial distal margin, third at angle of mesial margin. Fixed endite with four spatulate, deeply forked biting setae, each backed by stout, sharp spine, and with three simple spines at outer angle. Inner lobe of articulated endite with seven sharp spines distally. Outer lobe bearing six long, curved spines distally.

Maxilliped (Fig. 3A) with two-jointed basipodite; coxal joint very short but wide; basis rather long and constricted proximally. Palp four-jointed, with second joint longer than others combined, and greatly expanded laterally. Outer margin of this joint armed with triangular teeth; distal extremity with several large, blunt spines. Third and fourth joints with stout, curved spines on inner margin. Endite (Fig. 3C) bearing terminal row of eight stout spines, spatulate distally, and one plumose seta. Median margin with four stout coupling hooks. Epipodite (Fig. 3F) somewhat kidney-shaped, deeply concave, and borne on rather broad membranous peduncle. Anterior margin folded over in rounded flap, finely setulate. Posterior extremity with tapered, ciliated lobe.

Coxal joint of cheliped (Fig. 4A) small and almost hemispherical. Three-jointed exopodite (Fig. 4B) attached to outer margin of basis at articulation with coxa. Basis robust, armed with several plumose setae and sharp spine. Merus triangular in cross-section, extending anteriorly to underlie portion of carpus. Carpus narrow proximally, greatly inflated distally, strongly sculptured with ridges and blunt teeth. Propus (Fig. 4C) nearly equal in length to carpus, smoothly inflated proximally, and constricted at base of fixed finger. Cutting edge (Fig. 4D,E) irregular near base, with row of serrate spines distally. Terminal claw strongly curved. Dactylus (Fig. 4D) smoothly curved, with number of spines along cutting edge (Fig. 4E).

Pereopod II (Fig. 4F) strong, elongate appendage, nearly half as long as entire specimen. Coxal joint rounded, with small, blunt spine anterolaterally. Basis bearing minute, single-jointed exopodite on proximal anterior margin, and blunt



Figure 4. *P. largoensis*, n. sp. Appendages of female. A: right cheliped. B: exopodite of cheliped. C: propus of right cheliped. D: tip of propus of right cheliped—medial surface. E: propus and dactylus of right cheliped. F: left pereopod II. G: right pleopod I. Scales in mm.

spines distally. Ischium very short; merus, carpus, and propus with several stout, sharp spines. Dactylus curved, with five small, sharp spines on posterior margin and one on anterior margin. All joints except dactylus provided with plumose setae.

Pereopod III (Fig. 5A) much shorter than preceding. Coxal joint with small,

blunt tooth on anterior margin. All joints with some plumose setae. Propus with sharp, curved spine distally, flanking dactylus on inside, and two blunt spines and long seta on outside. Merus, carpus and propus all bearing number of short, stout, blunt spines of characteristic shape, variously conical or capitate, on their posterior surfaces. Dactylus long and fairly straight, claw curved.

Pereopod IV (Fig. 5B) slightly smaller than PIII. Coxal joint with two blunt teeth. Basis stout and somewhat angled distally, with three sensory setae on anterior margin. Remainder of appendage as in preceding.

Remainder of pereopods with coxal joint unarmed. Pereopods V and VI (Fig. 5C,D) shorter and stouter than preceding appendages. Merus with few, carpus with many capitate spines posteriorly. Propus abruptly narrower, with two capitate spines and one (P-V) or two (P-VI) long, sharp spines distally, and with sensory seta at dorsal midpoint. Dactylus longer than propus, very slender. Claw strongly curved.

Pereopod VII (Fig. 6A) smaller, but otherwise similar to P-VI. Carpus with two sharp, simple spines distally. Propus with four sharp, curved spines distally. Dactylus twice length of propus, slightly curved, with two spinules on posterior margin. Last five pereopods on right side reduced in size, although form and armature appear identical with opposing appendages.

First abdominal segment bearing rudimentary biramous pleopods (Fig. 4G). Each branch single-jointed; exopodite very small and bearing two setae, and endopodite bearing three.

Uropods (Fig. 6B) biramous, with stout peduncle. Endopodite of three nearly equal joints, all bearing simple setae. Exopodite of two joints, first quite short and second somewhat longer, with the second bearing two simple setae.

Description of Male.—(Allotype, Fig. 1B.) Mature specimen, length 3.06 mm. Width at carapace 0.68 mm. Generally more robust than female. Carapace constituting almost one-fourth of total length. Pleon very short, less than one-sixth of total length and only slightly depressed. Color as in female.

Carapace shaped as in female, slightly longer than wide. Rostrum (Fig. 1G) terminating in acute point, with two lateral teeth located slightly behind and below, giving tridentate appearance. Epistome bearing three median spines; ventrally larger than others. Eyelobes more pointed than in female, with distinct visual elements.

Pereon generally as in female. Pereonites 4 and 5 with one minute tooth, pereonites 3 and 6 with two, at the anterior corners. Conical genital papilla (Fig. 6D) on posterior ventral surface of pereonite 7 low but distinct, directed posteriorly, distally bilobed, with two openings.

Pleotelson with individual pleonites less than half as long as the same segments in female. Only first pleonite bearing pleopods.

First antenna as in female, but very robust. First joint of outer flagellum beyond common joint bearing two aesthetascs at inner distal angle; next two joints each bearing single aesthetasc.

Second antenna two-thirds of length of basal joint of first antenna; fourth joint bearing two and fifth joint bearing four sensory setae; terminal joint bearing four simple setae. Otherwise as in female appendage.

Labrum and labium as in female.

Mandibles generally as in female, with some variation in setal cluster (Fig. 2B). Maxillule as female.

Maxilla similar to female appendage. Distal margin with only two biting setae posterior to filter row. Outer lobe of articulated endite with two spines near outer margin and cluster of six at inner margin.

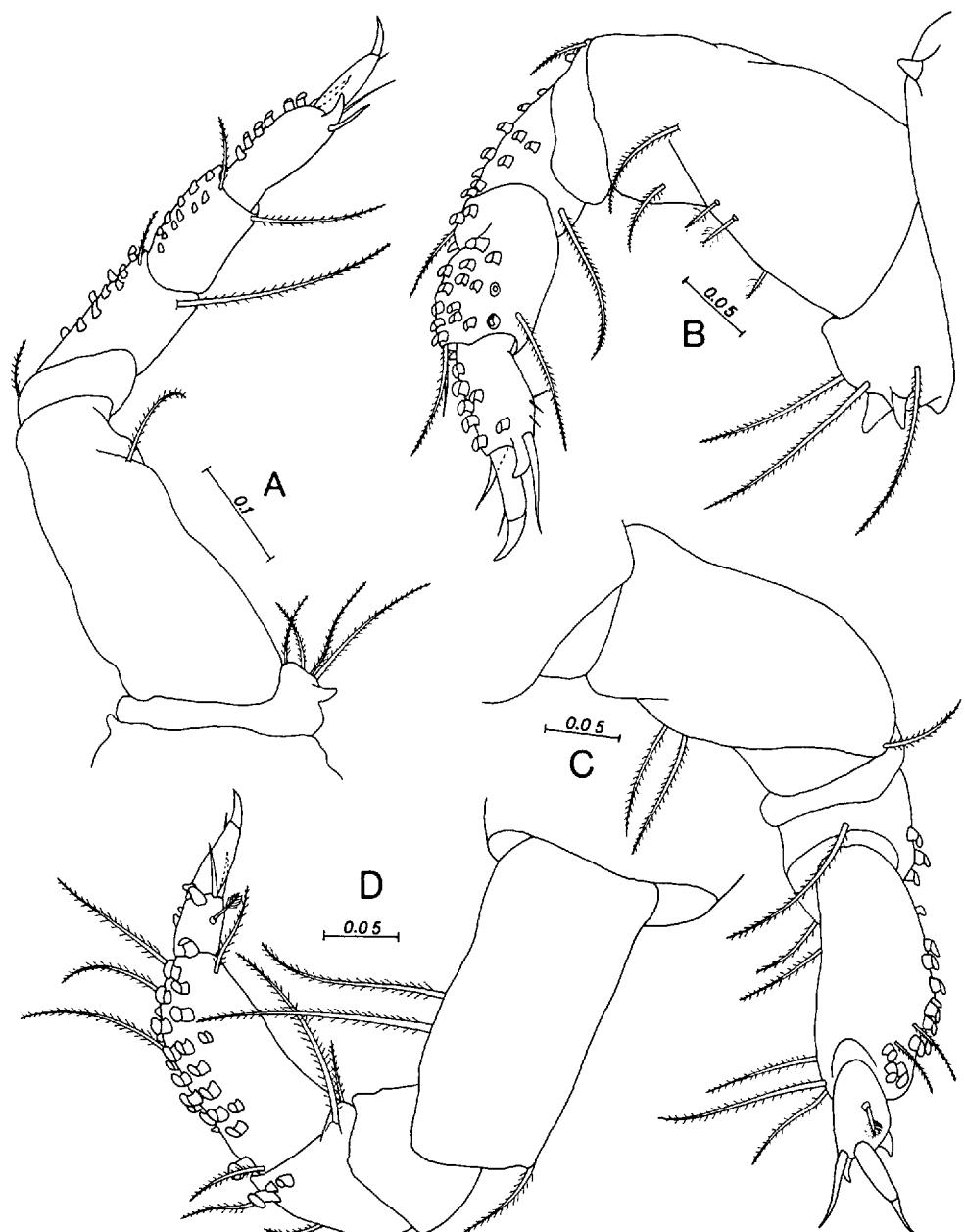


Figure 5. *P. largoensis*, n. sp. Appendages of female. A: left pereopod III. B: right pereopod IV. C: left pereopod V. D: left pereopod VI. Scales in mm.

Basipodite of maxilliped as in female. Endite with nine spatulate spines distally. Epipodite as in female.

Left cheliped similar to that of female, but somewhat less sculptured. Right cheliped (Fig. 6E) greatly enlarged. Coxa and exopodite as in left cheliped. Basis similar to that of left appendage, but much thicker. Merus more setose. Carpus greatly inflated distally, reaching its greatest diameter at midpoint. Ventral surface

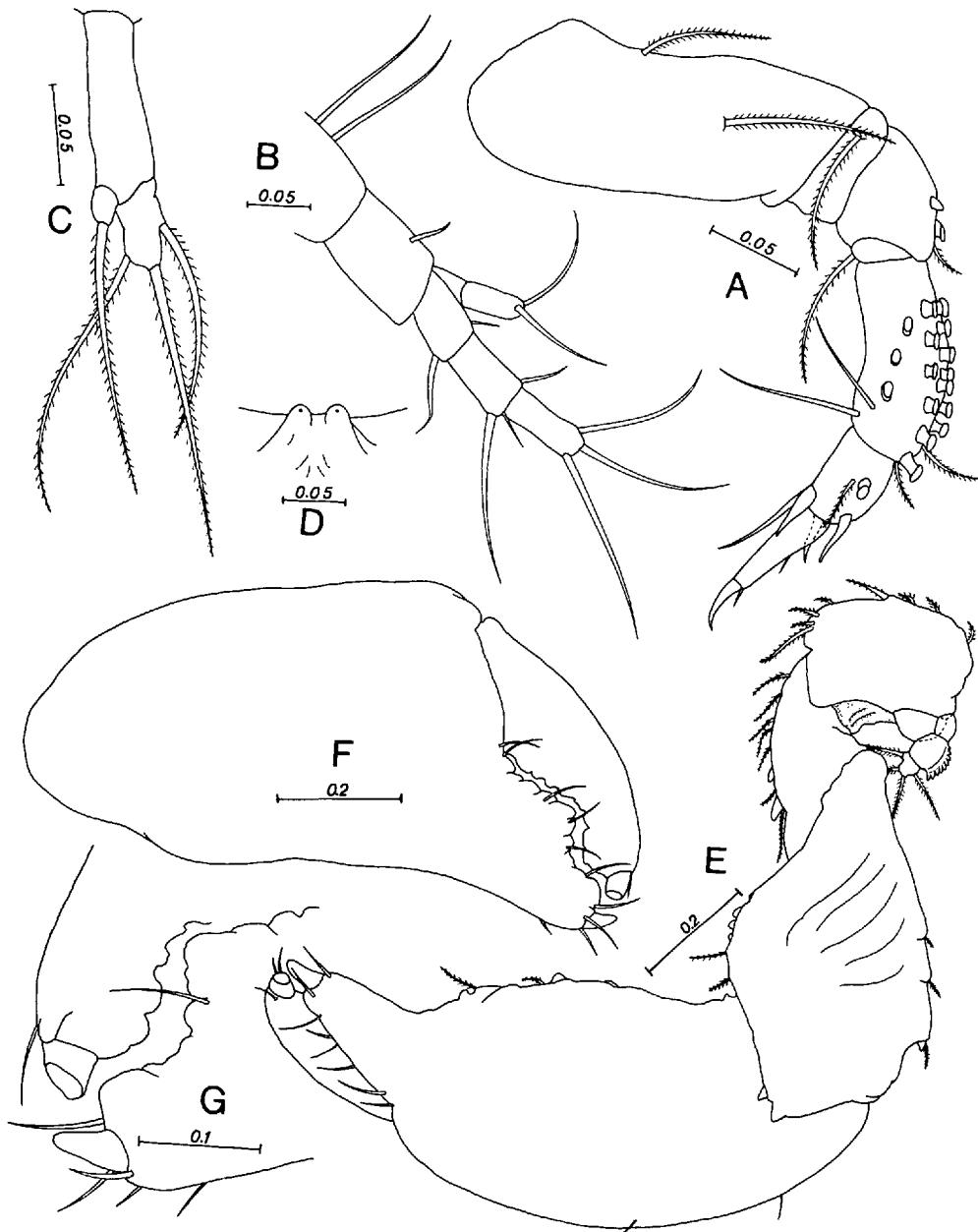


Figure 6. *P. largoensis*, n. sp. A, B: Appendages of female. C-G: Appendages of male. A: right pereopod VII. B: left uropod. C: left pleopod I. D: genital papillae. E: right cheliped. F: right chela. G: tip of right chela. Scales in mm.

somewhat rugose; remainder of joint lightly sculptured. Propus (Fig. 6F) very greatly inflated, half again as long and wide as carpus, unsculptured, with granular surface. Fixed finger compressed; cutting edge (Fig. 6F,G) crenulated ridge extending down midline, forming distinct hump in center. Claw set slightly to inside,

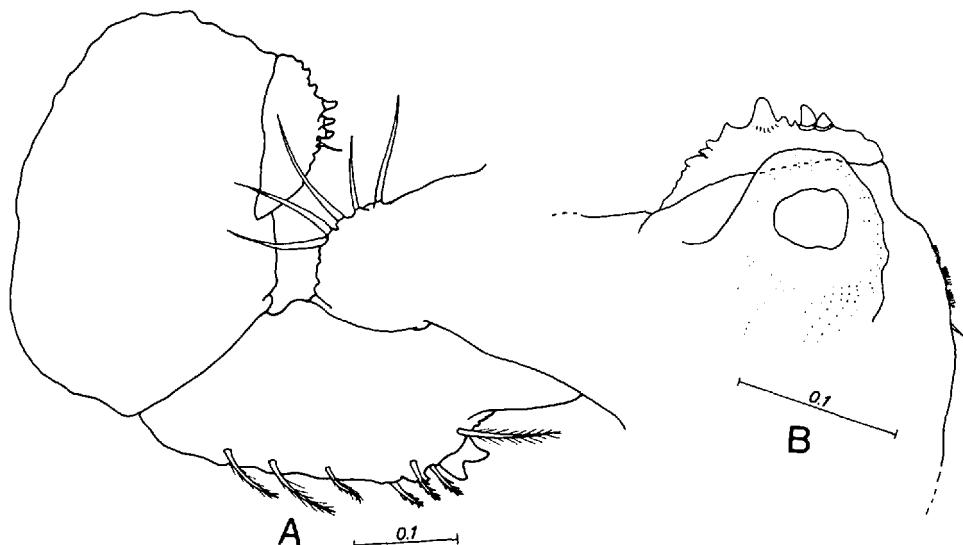


Figure 7. *Pagurapseudes spinipes* Whitelegge, 1901. A: basis, merus, and carpus of right cheliped, female syntype. B: basis of male cheliped. Protuberance is fused coxal joint. Both figures show single-jointed exopodite. Scales in mm.

with end of cutting ridge forming a shoulder against which claw of dactylus closes. Dactylus (Fig. 6F,G) strongly curved, flared at base and attenuate distally. Distal inner surface, at base of claw, bearing low projection. Cutting edge matches contour of propodus.

Pereopods II–VII as in female.

Pleopods (Fig. 6C) rudimentary, longer than in female. Basal joint long and slender. Single-jointed endopodite slightly more than one-third of length of basal joint and bearing three setae. Exopodite minute, bearing single seta.

Uropods as in female, but with three terminal setae on endopodite instead of four. Last joint of endopodite bearing single small, terminal sensory seta.

Diagnosis.—Within *Pagurapseudes*, *P. largoensis* shows closest affinities with *P. laevis* Menzies, although several characters clearly set these two species apart. *P. largoensis* and other Caribbean *Pagurapseudes* are distinguished from Indian Ocean species described by Baicescu (1976) by presence of chelipedal exopodites and by pereopods II having exopodite either one-segmented or lacking altogether. From remaining members of genus, *P. largoensis* differs by having second antenna composed of 7 joints (but see comments below on *P. laevis*).

P. largoensis differs from *P. laevis* by having three-jointed instead of one-jointed exopodite on chelipeds, and biramous pleopods on first pleon segment in the female. Distinguished from *P. guttarti* Gutu and Gomez by one-jointed exopod on PII; by biramous pleopods and uropods; by the row of 6 teeth (instead of 4) on the proximal stem of mandibular incisor process; and by terminal, dorsal seta on propodus of pereopod VII which is shorter than dactylus, rather than much longer as in *P. guttarti* (Gutu and Gomez, 1976: Fig. 2E). *P. largoensis* differs from *P. bouri* (Bouvier) by three-jointed exopodite on cheliped and presence of exopodite on PII, in addition to number of joints of second antenna. *P. largoensis* differs from *P. spinipes* Whitelegge in shape of rostrum and basal joint of second

antenna; by three-jointed exopodite on cheliped and presence of exopodite on PII; and by two-jointed exopodite of the uropods.

In addition to the characters mentioned above, several other features distinguish *P. largoensis* from Indian Ocean taxa. From *P. tricolae*, differs by having rostrum of different shape, and by lacking lateral spines on carapace; basal joint of second antenna is of quite different shape; and PII is long and robust, while in *P. tricolae* it is small (Bacescu, 1976: 6). *P. largoensis* is distinguished from *P. varians* Bacescu by having second antenna seven-jointed instead of six-jointed, and by lack of prominent projection on the epistome. In addition, *P. varians* is described as having colored carapace (Bacescu, 1976: 5) while *P. largoensis* is completely white. *P. dactylifrons* Bacescu is distinguished from new species by filaments borne on aesthetascs of first antenna (Bacescu, 1976: Fig. 2M).

DISCUSSION

One of the most interesting features of *P. largoensis* is the row of six prominent teeth borne on the proximal anterior margin of the mandibular incisor process. This feature appears to be unique to the genus *Pagurapseudes*, in which it is found in at least three species. Gutu and Gomez (1976: 86; Fig. 1C) describe and figure a series of four such teeth in *P. guttarti*. Examination of specimens from the type series of *P. spinipes* Whitelegge revealed that this species also possesses six teeth, although some specimens bear a small seventh tooth. Since tanaidacean mandibles are often examined and figured from a partially posterior aspect, in which position this feature is obscured, the character may have been overlooked in other species also. These teeth are often further obscured by detritus which collects between them. A character such as this would appear to have at least generic significance, and reexamination of other species in which it has not been described is warranted.

The function of these teeth is unknown, but may be related to the somewhat sedentary habit and preference for coarse substrate. They may be used in grazing attached material from hard surfaces, since the orientation suggests a scraping function.

P. largoensis bears three setae on the palp of the first maxilla, one of the very few characters shared with the other two Caribbean species, while *P. laevis* bears four setae on this appendage and *P. spinipes* bears six. This character is not mentioned in descriptions of other species.

P. largoensis appears to be closer to *P. laevis* than to other Caribbean species. Common characters include the one-jointed exopod on PII; similar number of joints in both antennae (but see comments on second antenna below) and the uropodal flagella; and similar sculpturing of the rostrum, basal joint of AI, cheliped, and second joint of the maxillipedal palp. Examination of Menzies' type material (with the exception of the holotype) confirmed these points, but left some questions due to the poor condition of the material. Most specimens had been dissected, with damaged and missing appendages. Only the female allotype had intact mouthparts, but as the specimen was broken in three pieces, and dissection could not have been accomplished without further serious damage, the question of teeth on the mandibular incisor process remains unanswered. The second antenna of this specimen appeared to be composed of six segments, as described by Menzies, while the specimen labeled "male paratype" (which has apparently dried out at some time in the past) had a seven jointed second antenna. Segmentation of the appendage was not completely clear in either specimen. The Mexican specimens which constituted the remainder of Menzies' material were

in such poor condition as to be useless. It is hoped that the species will be collected again so that this question may be resolved.

The present species was collected while inhabiting empty shells of several species of gastropod, although these were not identified. A clear preference for the shell of one species of mollusc was not apparent, and selection appeared to be based on morphological characteristics of the shell. Inhabited shells shared the characteristics of a broad aperture and large body whorl.

It should be noted here that while examining part of the *P. spinipes* material (THETIS station 13 and 35, Australian Museum No. G-2405; and unspecified THETIS station, No. G-2404, only), the species was discovered to bear a rudimentary exopodite on the cheliped. This consisted of a single segment, variously triangular or semicircular, fused to the basis in the usual position (Fig. 7A,B). No specimens seen had any trace of an exopodite on PII. The two-jointed exopodite figured by Whitelegge (1901: 212; Fig. 16F) is similar to that figured by Bacescu (1976: Fig. 2J) for *P. tricolae*. Failure to mention the appendage in the description, and his further statement (Whitelegge, 1901:214) that it was present on only a single male, indicates that perhaps a representative of a second species was present in the material.

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